mercury, and the air in the chamber is no longer in connection with the receiver. But as the drum contains three chambers, one of them is always above the mercury; hence the action is continuous. As the chamber revolves W becomes more and more immersed in the mercury, and the air is forced out through the channels Z into the space between the drum and casing, from whence it is removed by the auxiliary pump.

Fig. 3 illustrates the glass attachment, which can be fitted on to the tubes R and R′, Fig. 2, by means of the ground pieces L and L_1. The receiver to be exhausted is attached at E. A manometer H, with a drying chamber P filled with phosphorus pentoxide, is employed to measure the pressure. It also serves as an automatic valve; at atmospheric pressure the orifice O is open; therefore the auxiliary pump connected at S exhausts the receiver fitted at E, directly through the opening O and the connecting tube P. On a vacuum of 20 mm. being attained, the mercury sinks in the right-hand limb, and, rising on the left, closes the opening O as illustrated in the figure; the mercury pump is then started.

Figures are supplied showing the extreme vacuum which can be obtained in a few minutes. Thus in five minutes the MacLeod gauge registered only 0·027 mm., and after fifteen minutes 0·000003 mm. This shows that the pump works extremely rapidly and very efficiently. If it is capable of doing all that is claimed for it, the Gaede pump should prove of great value either for research work or for showing lecture experiments with high vacua.

THE CAUSE OF EARTHQUAKES.

AMONG the results produced by the San Francisco earthquake of April 18, 1906, must be reckoned a memoir, by Prof. T. J. J. See, covering 140 pages of the Proceedings of the American Philosophical Society (vol. xlv., October–December, 1906), on the cause of earthquakes, mountain formation, and kindred phenomena. The explanation adopted is a development of an old-fashioned idea, and is supported by quotations from the writings of natural philosophers from Aristotle down to Charles Darwin. Earthquakes, with volcanoes and mountain ranges, are all ascribed to the explosive power of steam formed within or just beneath the heated rocks of the earth's crust, chiefly by the leakage of sea water through the ocean beds; the pressure of this steam forces the lava in a lateral direction, and its subsequent condensation leads to the subsidence of the sea bottom often observed after great earthquakes; the lava forced aside may either break out through volcanic vents or may lift the overlying rocks into mountain ranges, and, when the movement is sudden, give rise to faults and fractures which are the result, not the cause, of earthquakes.

It is round these last words, italicised by Prof. See, that criticism naturally centres, and the first consideration which arises is the verbal one of what is an earthquake and what is a cause. An earthquake, as ordinarily understood, is a shaking of the earth, and this shaking is due, wholly in the great majority of cases, and very largely in the remainder, to the molecular movements involved in the transmission of elastic wave motion. In the case of great earthquakes, fractures of the solid rock, accompanied by more or less displacement of the opposite sides of the fissure, are often found, and as the shaking of the earth is greatest near these, and the disturbance is propagated outwards from them, they have been regarded as the cause of earthquakes. In other cases, where no actual fissure is observed at the surface, there is good reason to suppose that the earthquake was caused by an underground fracture, which did not reach the surface, and there can be no doubt that this explanation is adequate in almost, if not quite, every case; but even if the fracture is the immediate cause of the disturbance which is commonly known as an earthquake, the explanation is still incomplete, for we have not reached the cause of the fracture.

It is to this ultimate cause that Prof. See appears to apply the term earthquake, and he is probably right in rejecting the tectonic hypothesis either in the form in which it presents itself to him or in the more ordinary one which regards the fractures as the result of compressional strains, largely due to the secular contraction of the earth, but his explanation fails to account for the remarkable connection between the irregular shifting of the earth's axis and the occurrence of great earthquakes. That these irregular movements of the axis are greatest when large earthquakes are most frequent is a certain, but as yet unexplained, fact; it seems to necessitate displacements of matter in the earth on a far larger scale than is indicated by the differential measurements which alone are open to us. Prof. See's explanation, though it provides for lateral and vertical displacements of matter, necessitates the elevations and depressions being so closely contiguous as practically to neutralise each other's effects, and, therefore, fails as an explanation of the ultimate cause of earthquakes, while it in no way affects the current acceptance of fracture as their immediate cause.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LEEDS.—The retirement of Prof. Miall, F.R.S., from the chair of biology, which he has occupied in the Yorkshire College, and subsequently in the University of Leeds, since the year 1876, was recently made the occasion for expressing in a tangible way the esteem and regard in which he is held by his colleagues and friends. A testimonial committee, of which the Vice-Chancellor (Dr. Bodington) was chairman, was formed, and a ready response was obtained to the circular inviting subscriptions for this purpose. Among the testimonials to Prof. Miall which have been thus provided is a portrait by Mr. Frederick Yates, intended to be hung in the hall of the University. The presentation of this portrait was made at a recent meeting in the University library, when a large number of his colleagues and friends were present. The Vice-Chancellor, who presided and made the presentation, spoke in warm and feeling terms of the eminent services which Prof. Miall had rendered to the college and University, as well as to the cause of science, and described him as having been original as a teacher, eminent as a scientific worker, and active as a business colleague. Subsequent speakers included Mr. S. P. Unwin, Dr. Eddison (emeritus professor of the University), and Prof. Smithells. Prof. Miall, in acknowledging the presentation, gave a short historical sketch of the foundation of the Yorkshire College of Science and its development into the Yorkshire College and subsequently into the University of Leeds.

The chair of biology will in future be divided into the professorships of zoology and of botany. To the former has been appointed Dr. Walter Garstang. Prof. Garstang has held research fellowships in zoology at Owens College, Manchester, and subsequently at Lincoln College, Oxford, where he has filled various appointments as lecturer and examiner. He is at present chief naturalist to the Marine Biological Association in charge of the Lowestoft Laboratory.

To the chair of botany Mr. V. H. Blackman has been appointed. Prof. Blackman was sometime fellow of St. John's College; he has held an assistantship in the British Museum, having charge of the collection of fungi, and he is at present engaged in botanical teaching, being a recognised teacher of that subject in the University of London.

In connection with the new department of fuel and metallurgy under Prof. Bone, F.R.S., the Institute of Gas Engineers has established a research fellowship of the value of 100*l.* a year.

The extensions of the University buildings upon which the council is at present engaged comprise:—(1) an extension of the main building in College Road for the better accommodation of biology and of arts teaching; (2) an extension of the civil and mechanical engineering department; (3) the erection of a detached block for the department of electrical engineering; (4) an extension of the cloth finishing department; (5) the completion of the block of buildings for the mining and metallurgical departments. The last-mentioned block will be ready for occupation by the students at the beginning of next session, in October. In addition to these buildings, the University is

erecting a new boiler house and lavatories; is proposing to extend the refectory; is adapting a large dwelling house for the purposes of an extension of the geological department, and is uniting the house by means of a bridge at the first-story level with the present geological department of the University; and is adapting other dwelling houses for the use of women students and for seminar work.

THE second International Congress on School Hygiene will be opened on August 5, at the request of the King, by Lord Crewe. The complete success of the meetings seems to be assured. The German Government has not only decided to send delegates to the congress, but, by permission of the Kaiser, Prince Eitel Friedrich has accepted the office of a vice-patron of the congress. While still adhering to its resolution not to issue official invitations to foreign Governments to send delegates, the Board of Education has arranged with the Foreign Office to take such steps as are likely to remove any misunderstanding which might have prevented some foreign delegates from accepting the invitations issued. The meetings will be held at the University of London, and will last until August 10. Sir Lauder Brunton, F.R.S., the president, will deliver the inaugural address on August 5. The sectional meetings will commence on the following day. There are eleven sections in all; their subjects and the name of the president in each case are as follows:—(1) The physiology and psychology of educational methods and work, Sir James Crichton Browne, F.R.S.; (2) medical and hygienic inspection in school, Prof. W. Osler, F.R.S.; (3) the hygiene of the teaching profession, Dr. T. J. Macnamara, M.P.; (4) instruction in hygiene for teachers and scholars, Sir William J. Collins, M.P.; (5) physical education and training in personal hygiene, Sir John W. Byers; (6) out-of-school hygiene, holiday camps and schools: the relation of home and the school, Lord Kinnaird; (7) contagious diseases, ill-health, and other conditions affecting attendance, Sir Shirley F. Murphy; (8) special schools for feeble-minded and exceptional children, Mr. W. H. Dickinson, M.P.; (9) special schools for blind, deaf and dumb children, Lord Crewe; (10) hygiene of residential schools, Dr. Clement Dukes; (11) the school building and its equipment, Mr. T. E. Colcutt. An exhibition of school building and furnishing appliances has been arranged in connection with the congress.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 6.—"On the Two Modes of Condensation of Water Vapour on Glass Surfaces, and on their Analogy with James Thomson's Curve of Transition from Gas to Liquid." By Prof. Fred. T. **Trouton**, F.R.S.

Experiments made with glass wool to determine the amount of water condensed on the surface of glass when in equilibrium with various vapour pressures showed that below a critical pressure, which is about 50 per cent. saturation, there are two distinct modes in which the condensed water can exist.

Thus for the same vapour pressure, if the condensation is in one of these forms, called for convenience the α type, there is much less condensed material present on the surface than in the other form, called the β type; or, to put it in another way, for the same amount of condensed vapour the pressure is greater when the condensation is of the α form than when it is of the β form.

Condensation will take place of the α type if the surface has been thoroughly dried at high temperatures, while of the β type if the drying has only been effected at ordinary temperatures, though in that case also the vapour pressure may be zero.

When the condensation is of the β type the curve, connecting pressure with the amount of condensed water, is found to be very similar to that for wool or cotton, but when the condensation is of the α type the curve is quite different. Thus, starting with the surface very dry, the pressure runs up quickly for relatively little condensation until a critical pressure is reached; after that, on further additions to the surface condensation, the pressure diminishes. This is attributed to a transformation into the β state supervening at this point, when consequently the vapour pressure is in excess of equilibrium, and thus a depletion of the vapour in the surrounding space results, with a corresponding fall in vapour pressure. If moisture be continuously supplied the pressure will, after reaching a maximum, begin to rise, and ultimately pass to saturation.

The analogy with James Thomson's curve of transition from gas to liquid is pointed out. In the one case there is attraction between water-vapour particle and water-vapour particle, in the other between glass and water vapour. The condensation of the α type corresponds to the supersaturated vapour stage in the transition curve, while the β corresponds to its liquid stage.

Where the surface is not completely dry, the fact that the condensation is in the β form, on vapour coming in contact with the surface, is attributed to there being an example of that type already on the surface; but if this is not present, that is, if the surface is desiccated, the condensation is of a type allied to supersaturated vapour rather than to the liquid.

A paradoxical consequence of there being these two modes of condensation is pointed out, namely, that a relatively wet surface is capable of drying one wetter than itself.

As an illustration of the phenomenon a simple experiment is given, in which two dishes of phosphorus pentoxide are placed under a bell jar, with only this difference, that one of the dishes is first made dry by heating. It is then found that the pentoxide which can initially obtain some moisture from contact with the damp dish absorbs the moisture in the bell jar, and ultimately runs liquid, while the other remains dry.

"On the Velocity of Rotation of the Electric Discharge in Gases at Low Pressures in a Radial Magnetic Field." By Prof. H. A. **Wilson**, F.R.S., and G. H. **Martyn.**

The apparatus used in this investigation was a small vacuum tube consisting of two concentric glass tubes cemented into aluminium discs. The discs served as electrodes, and the discharge was passed between them through the annular space between the glass tubes.

An iron bar was fixed along the axis of the vacuum tube, and could be magnetised so as to produce a radial field in the space between the glass tubes.

The discharge was produced by a large secondary battery, and its velocity of rotation round the annular space was measured. The variation of the velocity with the strength of the magnetic field, with the pressure of the gas, and with the current carried by the discharge, was investigated in air, nitrogen, and hydrogen.

The velocity was found to be nearly proportional to the strength of the magnetic field and inversely proportional to the gas pressure. The velocity in hydrogen was about thirteen times the velocity in air or nitrogen.

It is shown that theoretically the velocity should be proportional to the product of the two ionic velocities, and the results obtained, together with previous measurements of the Hall effect, enable the velocities of both the positive and negative ions to be calculated. The negative ions are found to have much higher velocities than the positive ions.

June 13.—"*Miadesmia membranacea*, Bertrand; a New Palæozoic Lycopod with a Seed-like Structure." By Dr. M. **Benson.** Communicated by Dr. D. H. Scott, F.R.S.

The vegetative organs of this interesting new type were discovered by Bertrand in 1894. He found them in sections of a calcite nodule from the Gannister beds of Hough Hill, England. A large quantity of new material has become available, and now not only are more details known as to the vegetative organs, but a fairly complete knowledge of the reproductive organs is possible.

Miadesmia was exceedingly minute, its stem slender and without any trace of skeletal tissue. It is the first Palæozoic Lycopod of herbaceous character known structurally. The megasporophylls, which were identified by Dr. D. H. Scott, F.R.S., in 1901, show a more advanced